

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of)	
)	
Request by Acconeer AB)	
For Waiver of Section 15.255)	File No. _____
of the Commission's Rules)	

REQUEST FOR WAIVER

Acconeer AB (“Acconeer”), pursuant to Section 1.3 of the Federal Communications Commission’s (“FCC” or “Commission”) rules,^{1/} hereby respectfully requests a waiver of Section 15.255.^{2/} Grant of this targeted waiver will allow Acconeer to market in the United States a 60 GHz short-range radar system that provides for vehicle safety and security. Acconeer’s request is consistent with the intent of the rule and prior waiver grants, and will serve the public interest by promoting vehicular safety and enhanced security – saving lives and reducing injuries.

INTRODUCTION

Acconeer is a radar sensor company based in Lund, Sweden. Acconeer was formed in 2011 to develop innovative technologies based on research pioneered at Lund University, and was listed on Nasdaq First North in 2017. Acconeer is a leader in developing small, power efficient and cost-efficient radar systems that will enable a safer and more sustainable future.

Acconeer has developed an innovative 60 GHz pulsed coherent radar sensor which has the benefits of being produced in a compact form factor (*i.e.*, 5x5x0.8 mm) while consuming low amounts of power. Using the 60 GHz band allows Acconeer’s radar sensor to detect extremely small variations in the local environment, such as the pulse of a human being, while using small antennas that allow integration of the sensor into small form factors.

^{1/} 47 C.F.R. § 1.3.

^{2/} 47 C.F.R. § 15.255.

Acconeer's radar system can be used in a large variety of applications such as fixed systems that detect the presence of humans inside vehicles, and can be incorporated into mobile, battery operated devices such as cell phones, laptops, smart watches and robots. Due to the low power consumption, Acconeer's radar sensor is ideally suited to various Internet-of-Things (IoT) applications detecting the presence of objects or distance to objects in use cases where cabling is not feasible and long battery life is important.

DISCUSSION

Acconeer seeks waiver of the Section 15.255 technical requirements. The underlying purpose of this rule, which is to allow for harmonious operations amongst users,^{3/} would not be undermined by grant of this request. There is good cause to grant the waiver, as doing so would be in the public interest because of the evident benefits of the technology and the request is in line with a prior Commission decision allowing operations under the same technical parameters.^{4/}

A. Request for Waiver of Section 15.255

Section 15.255 of the Commission's rules governs unlicensed operations within the 57-71 GHz band. The Acconeer radar sensor, which operates in 57-64 GHz, uses Pulsed Coherent Radar ("PCR") technology. While operation in this band allows for the use of wide bandwidth which enables high accuracy measurements with low false positive rates, the power levels in

^{3/} *Google LLC Request for Waiver of Section 15.255(c)(3) of the Commission's Rules Applicable to Radars used for Short Range Interactive Motion Sensing in the 57-64 GHz Frequency Band*, Order, 33 FCC Rcd 12542 at ¶ 6 (2018) ("Google Waiver") ("allowing Google Soli sensors to operate at the requested power levels will not materially change the operating environment in the 57-64 GHz band such that there would be an increase in potential harmful interference to other users in the band, and [] the higher power Google Soli device will be able to cooperatively share this spectrum with all users. Thus, we find that the waiver standard has been met."); *Leica Geosystems AG Request for Waiver of Section 15.255 of the Commission's Rules Applicable to Radars used on Unmanned Aerial Vehicles in the 60-64 GHz Frequency Band*, Order, 35 FCC Rcd 7929 at ¶ 4 (2020) ("Leica Waiver") (good cause exists to grant a waiver that "will not materially change the operating environment and thus will not increase potential harmful interference to other users in the 57-71 GHz band.").

^{4/} See Google Waiver.

Section 15.255 are not sufficient to provide an acceptable signal to noise ratio (“SNR”) for accurate detection. Thus, to achieve the promise of Acconeer’s technology, waiver of the technical rules is required.

Acconeer’s request here encompasses four use cases related to vehicular safety and security:

Use case	Feature	Application
Vehicle Interior detection	Passenger detection	Interactive motion sensing or fixed installation
Vehicle Interior detection	Seat belt alarm	Interactive motion sensing
Vehicle Interior detection	Intruder alarm	Interactive motion sensing or fixed installation
Vehicle Access control	Gesture control	Interactive motion sensing or fixed installation

Section 15.255 allows operation of field disturbance sensors that are employed for fixed operation or used as short-range devices for interactive motion sensing.^{5/} Acconeer’s proposed uses fall into these categories, as discussed further below.

Acconeer seeks waiver of the Section 15.255 technical requirements to operate under the same technical characteristics as what FCC has allowed in a previous waiver,^{6/} specifically:

Table 1 Technical limits

Technical Specification	Requested limit
EIRP	+13 dBm
Transmitter conducted output power	+10 dBm
Power spectral density	+13 dBm/MHz
Transmit duty cycle	10% in any 33 ms

B. The Public Interest Benefits of Acconeer’s Radar Sensor

The FCC was established, in part “for the purpose of promoting safety of life and property through the use of wire and radio communications.”^{7/} The Acconeer radar provides for numerous safety and security benefits, both inside and outside of the vehicle – with negligent risk of interference to other users. For the reasons discussed below, grant of the waiver would further the public interest by allowing the introduction of a radar device for vehicles that would

^{5/} 47 C.F.R. § 15.255(a)(2).

^{6/} Google Waiver at 14.

^{7/} 47 U.S.C. § 151.

enable crucial public interest benefits. By detecting movements within and immediately outside of a vehicle, the device would ameliorate the risk of pediatric heatstrokes in vehicles, would improve seat belt detection and airbag deployment, and would advance vehicular theft detection and entry systems.

1. Passenger Detection

Over the past twenty years, almost 900 children have died due to Pediatric Vehicular Heatstroke.^{8/} All of these deaths could have been prevented with technology such as Acconeer's radar system which, operating in 60 GHz, can detect the presence of a child left in a vehicle with the proposed EIRP level. Millimeter wave radar systems have advantages over other types of sensing systems, including camera-based systems or in-seat occupant detection systems. Unlike cameras, mmWave radar provides depth perception and can "see" through soft materials, such as a blanket covering a child in a child restraint. Unlike in-seat sensors, mmWave systems can differentiate between a child and an object left on the seat, reducing the likelihood of false alarms. In addition, mmWave radar can detect micro-movements like breathing patterns and heart rates, neither of which can be accurately captured by cameras or in-seat sensors alone. Moreover, because passenger detection systems are only active when a vehicle is stationary, it is critical that such systems engage in low power consumption to protect the vehicle's battery supply. Delivering accurate detection at low power consumption is one of the key merits of Acconeer's PCR technology.

As the sensor only operates when the vehicle is stationary, this use case could be allowed as a fixed installation, though it also may be considered interactive motion sensing because it detects micro-movements that control the device, allowing for touchless control.

^{8/} See <https://www.noheatstroke.org>

2. Seatbelt Reminder and Airbag Suppression

Enhanced and persistent seatbelt reminders also can save lives.^{9/} Acconeer's radar technology can detect breathing patterns and heart rates in a manner that permits discrimination between people and inanimate objects. From a safety perspective, when the sensor is used for seatbelt reminder function, it can more accurately detect the presence of a human in a seat than current pressure sensor technology. The same sensor also can be used to control a vehicle's passenger airbag suppression system, which is required to prevent injury to children in the event of an accident.

This use case can be allowed as interactive motion sensing because it detects micro-movements that control the device, providing touchless control.

3. Intruder Alarm

The Acconeer radar sensor also can be used to enhance theft prevention systems by detecting a broken window or vehicle intrusion. While other sensors may be used for this purpose, mmWave radar is more efficient, especially when operating with the higher power levels requested in this waiver. For example, a camera-based sensor operates by taking multiple frames and comparing them, whereas radar takes a single scan and more accurately and efficiently acquires the same information. Thus, mmWave radar can increase the robustness of vehicle security systems. Furthermore, Acconeer's radar in particular can significantly reduce the power consumption of an intruder alarm, prolonging the vehicle battery life. Low power consumption of systems within a vehicle while the vehicle is stationary is critical to the performance of a vehicle battery. Delivering accurate detection at low power consumption is one of the key merits of Acconeer's PCR technology.

^{9/} NHTSA, The Effectiveness of Enhanced Seat Belt Reminder Systems (Dec. 2007), <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/810844.pdf>.

As this use case will operate only while a vehicle is stationary, but also detects and is controlled by movement, it can be classified as both fixed installation or interactive motion sensors.

4. Automotive Access Gesture Control

Acconeer's radar sensor also can be used for a gesture-based vehicle entry/exit system. Use of this technology, at the higher power levels enabled by the requested waiver, promotes public safety by allowing quick access to a vehicle in high-crime areas where it may be unsafe to loiter. The Acconeer sensor can recognize a foot movement, for example, to open a car trunk or when opening or closing a sliding door when the vehicle is stationary. While other sensors may also be used for this purpose (such as capacitive systems), Acconeer's technology can perform the function more robustly because of the millimeter accuracy provided by 60 GHz radar, allowing for precise recognition of multiple gestures and discrimination of false movements, while consuming small amounts of power. As noted, this low power consumption characteristic will greatly aid in prolonging a vehicle's battery life while in parked mode. This gesture control detection system is only active when the vehicle is stationary, when low power consumption is critical. Delivering accurate detection at low power consumption is one of the key merits of the Acconeer PCR technology.

In this instance, though the radar in the access control system is located on the exterior of a vehicle, it is integrated under the car and directed towards the surface on which the vehicle is parked. The car exterior and reflection of the parking surface greatly attenuates the signal, and, in addition, the high free space path loss of ~68 dB/m at 60 GHz carrier frequency provides a strong reduction in the signal power outside of the car exterior.^{10/} Furthermore, at 60 GHz there

^{10/} <https://www.everythingrf.com/rf-calculators/free-space-path-loss-calculator>

is an oxygen absorption peak that further limits signal propagation and reduces the risk of harmful interference.^{11/}

As the vehicle is stationary when the access system operates, and gesture control is used, it can be characterized as fixed installation or interactive motion sensing under Section 15.255(a)(2).

C. The Requested Waiver Poses a Negligible Risk of Interference

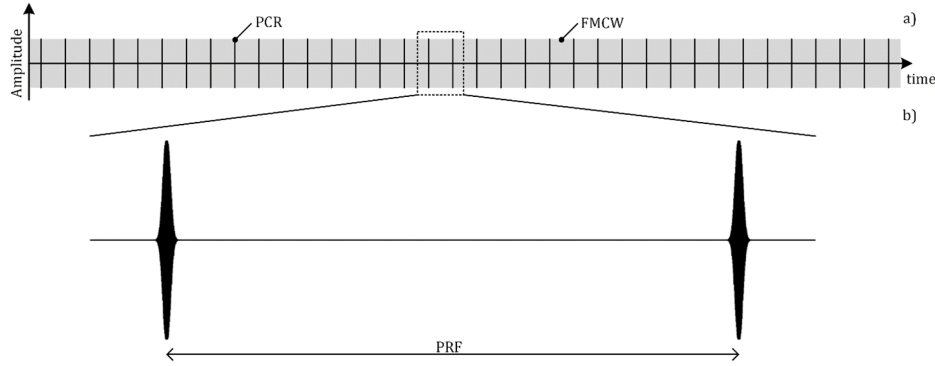
Allowing deployment of Acconeer's radar under this waiver request will result in a negligible risk of harmful interference to other users. For applications where the radar is contained within a vehicle, the already limited power levels are further attenuated by the vehicle's body, which acts as a natural shield to the 60 GHz signals. Operations of sensors outside of the vehicle will be attenuated by reflection towards the ground surface that will be shielded by the vehicle's exterior, thereby confining the majority of the energy below the vehicle. In addition, the high path loss and oxygen absorption peak at 60 GHz further limits signal power. Acconeer's proposal poses little risk of harmful interference to others.

Additionally, Acconeer's radar is PCR, rather than Frequency Modulated Continuous Wave ("FMCW") radar. Thus, under the same technical limits requested, while the average transmitted power will be identical, the maximum power spectral density will be lower for the PCR system. This lower power spectral density of PCR is achieved because the energy is spread across a wide band in a transitory manner.

Acconeer's PCR system relies on transmission of pulses in the 57-64 GHz band, which pulses are repeated with a determined Pulse Repetition Frequency (PRF), as illustrated below. The PRF is typically between 5 and 50 MHz, the bandwidth of the pulses is typically between 1 and 7 GHz, and the duty cycle is typically between 0.5% and 10%. The center frequency of the

^{11/} See e.g. Leica Order at ¶ 7.

pulses can further be frequency modulated. Figures 1.a and 1.b show the transmissions of the PCR alongside a typical FMCW system operating with the same EIRP.^{12/}



Figures 1.a and b. Illustration of PCR and FMCW signal as a function of time. Figure 1.b shows an enlarged portion of Figure 1.a. The PCR and FMCW signals have the same EIRP.

The resulting power spectral density (PSD) is illustrated in Figure 2.

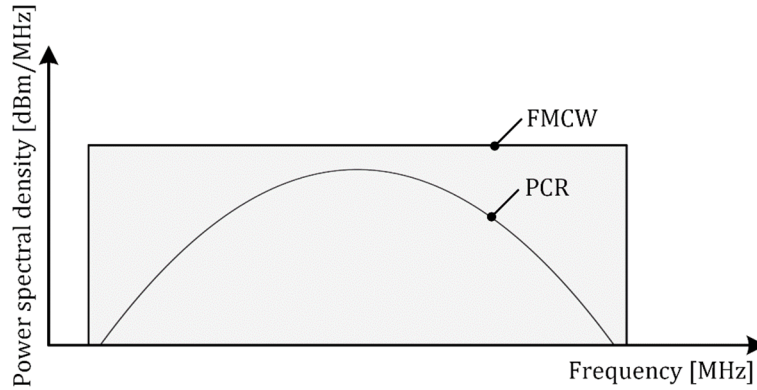


Figure 2 Illustration of the power spectral density of the PCR and FMCW signals as a function of frequency, given the technical limits in Table 1. The PCR signal bandwidth is derived from the length of the pulse, whereas the FMCW signal is continuously swept in frequency to provide the bandwidth.

The maximum PSD can be calculated as follows for the two systems

$$psd_{fmcw} = EIRP$$

$$psd_{pcr} = EIRP + 10 \cdot \log_{10} \left(\frac{10^6}{bandwidth} \right),$$

where, given the EIRP in Table 1, the maximum PSD is calculated according to Table 2, where the bandwidth is varied between 1,000 MHz and 7,000 MHz.

^{12/} The FMCW system relies on a continuous chirp to produce the bandwidth, as illustrated in Figure 2.

Table 2 Peak PSD of PCR and FMCW given the limits in Table 1

Bandwidth	<i>psd_fmcw</i>	<i>psd_pcr</i>
1,000 MHz	+13 dBm/MHz	-15 dBm/MHz
2,000 MHz	+13 dBm/MHz	-18 dBm/MHz
4,000 MHz	+13 dBm/MHz	-21 dBm/MHz
7,000 MHz	+13 dBm/MHz	-23 dBm/MHz

The low spectral density of PCR is achieved as energy is spread across a wide band. For this reason, each communication channel will contain a lower maximum power spectral density compared to a channel occupied by an FMCW radar operating with the same technical parameters, as described in Table 2. In addition, the energy is not spread evenly over the band (*e.g.*, example communication channel 1 and channel 3 will hold less energy than channel 2). For these reasons, a PCR system operating under the same technical parameters as an FMCW system pursuant to the limits in Table 1 will result in a negligible risk of harmful interference to others.

D. Acconeer’s Waiver Request Meets FCC Legal Requirements

The Commission may grant a waiver for “good cause” shown, and in particular when facts would make strict compliance with the rules inconsistent with the public interest.^{13/} For example, in *WAIT Radio v. FCC*, the DC Circuit required the Commission to consider the applicant’s request to operate outside of the rules when doing so would nonetheless accomplish the purpose of the rules.^{14/} The Court explained:

[A] general rule, deemed valid because its overall objectives are in the public interest, may not be in the “public interest” if extended to an applicant who proposes a new service that will not undermine the policy, served by the rule, that has been adjudged in the public interest.^{15/}

In other words, grant of a waiver is an appropriate form of relief when it furthers the public interest inherent in the underlying rules.

^{13/} 47 C.F.R. § 1.3; *WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969).

^{14/} *WAIT Radio* operated an AM broadcast station limited to operating during daylight hours to afford protect “white areas” that had no local service. *WAIT Radio* requested the ability to transmit at night, using a directional antenna so to limit its signal in the white areas. *WAIT Radio v. FCC*, 418 F.2d at 1154-55.

^{15/} *WAIT Radio v. FCC*, 418 F.2d at 1157.

The Commission already has granted waivers of Section 15.255 to allow for discrete modification of unlicensed operations in the 60 GHz band.^{16/} The waiver requested here is consistent with this precedent and meets the *WAIT Radio* standard. Allowing the Acconeer radar sensor to operate under the proposed technical parameters will provide for significant public benefits with no added risk of harmful interference to authorized users. Additionally, the proposed use would not undermine the purpose of the rule, which is to allow for varied unlicensed use of the band while protecting users of radio communications. The requested waiver fits clearly within the requirement set out in *WAIT Radio*:

The agency's discretion to proceed in difficult areas through general rules is intimately linked to the existence of a safety valve procedure for consideration of an application for exemption based on special circumstances.^{17/}

Given this conclusion, the court in *WAIT* determined that waiver requests made with supporting facts must be given a "hard look."^{18/} Acconeer's waiver request calls for similar treatment.

CONCLUSION

For the foregoing reasons, Acconeer respectfully requests that the Commission waive Section 15.255 of its rules so that it may market its 60 GHz radar product under the conditions described herein.

Respectfully submitted,

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^{16/} Google Waiver; Leica Waiver.
^{17/} *WAIT Radio v. FCC*, 418 F.2d at 1157.
^{18/} *Id.* (citation footnote omitted).